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Patrick H. McCollum
PD Holdings (USA) Inc.
Suite 1700
363 N. Sam Houston Parkway East
Houston, TX 77060

EXAMINER
TSAI, CAROL S W

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DETAILED ACTION

Claim Rejections - 35 USC § 102

1.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on
> sale in this country, more than one year prior to the date of application for patent in the United States.

2.   Claims 1, 2, and 4-7 are rejected under 35 U.S.C. 102(b) as being anticipated by U. S.

Patent No. 4,825,071 to Gadeken et al.

Gadeken et al. disclose a method for determining a property of a material, comprising

the steps of: (a) inducing, within said material, gamma radiation comprising energies greater than

about 3 MeV (see col. 3, lines 18-29 and col. 5, lines 44-46); (b) measuring a first gamma ray

spectrum and a second gamma ray spectrum resulting from said induced gamma radiation (see

col.. 3, lines 36-61); (c) normalizing said first and said second gamma ray spectrum in a first

energy region; (d) measuring down scatter gamma radiation in a second energy region of said

normalized first and second gamma ray spectra; and (e) determining said property from said

measure of down scatter radiation (see col. 4, lines 38-58).

As to claim 2, Gadeken et al. also disclose forming said induced gamma radiation by

means of a neutron source (see col. 3, lines 18-29).

As to claim 4, Gadeken et al. also disclose property being bulk density (see col. 5, line 33

to col. 6, line 18).

As to claim 5, Gadeken et al. also disclose material being earth formation penetrated

by a borehole (see col. 3, lines 10-11).

As to claim 6, Gadeken et al. also disclose measuring said property as a function of depth within said borehole by conveyance of apparatus along said borehole by means of a wireline (see col. 3, lines 18-35).

As to claim 7, Gadeken et al. do not disclose expressly measuring said property as a function of depth within said borehole by conveyance of apparatus along said borehole by means of a drill string.

It is, however, considered inherent that Gadeken et al. measuring said property as a function of depth within said borehole by conveyance of apparatus along said borehole by means of a drill string (see col. 11, lines 16-25), because such element is known to be necessary in order that the drill bit forms the borehole through earth formations as the drill string and the bottom hole assembly turn.

3.   Claims 8, 9, 11, 13-19, 21, and 24-26 are rejected under 35 U.S.C. 102(b) as being anticipated by U. S. Patent No. 3,864,569 to Tittman.

With respect to claims 8, 11, 13, 18, and 19, Tittman discloses an apparatus for measuring a property of a material, comprising: (a) a neutron source (see col. 2, lines 40-41 and col. 3, lines 49-54); (b) a first gamma ray spectrometer displaced from said source at a first axial spacing and which measures a first gamma ray spectrum resulting from gamma radiation induced within said material by said neutron source and (c) a second gamma ray spectrometer displaced from said source at a second axial spacing and which measures a second gamma ray spectrum resulting from said gamma radiation induced within said material by said neutron source (see col. 2, lines 42-56 and col. 3, line 65 to col. 4, line 53); and (d) a processor for (i) normalizing said second gamma ray spectrum to said first gamma ray spectrum in a first energy region

thereby creating a normalized second gamma ray spectrum and (ii) combining said first gamma ray spectrum with said normalized second gamma ray spectrum in a second energy region to determine a measure of said property (see col. 2, lines 56-63 and col. 5, line 60 to col. 7, line 7).

As to claim 9 and 21, Tittman also discloses said second spacing is greater than said first spacing (see col. 2, lines 50-51 and col. 4, lines 25-33).

As to claim 14, Tittman also discloses (a) identifying one or more elements within said material from said first gamma ray spectrum and said second gamma ray spectrum (see col. 2, lines 42-56 and col. 3, line 65 to col. 4, line 53); (b) determining lithology of said material from said one or more elements and (c) correcting said measure of bulk density for effects of said lithology of said material (see col. 6, line 36 to col. 7, line 7).

As to claims 15 and 24, Tittman also discloses said material being earth formation penetrated by a borehole (see col. 3, lines 15-25).

As to claims 16 and 25, Tittman also disclose conveying apparatus used to obtain said measure of said property within said borehole by means of a wireline (see col. 3, lines 19-25).

As to claims 17 and 26, Tittman does not disclose expressly conveying apparatus used to obtain said measure of said property within said borehole by means of a drill string.

It is, however, considered inherent that Tittman obtains said measure of said property within said borehole by means of a drill string (see col. Col. 1, line 61 to col. 2, line 2 and col. 3, lines 26-33), because such element is known to be necessary in order that the drill bit forms the borehole through earth formations as the drill string and the bottom hole assembly turn.

Claim Rejections - 35 USC § 103

4.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5.   Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gadeken et al. in

view of U. S. Patent No. 3,864,569 to Tittman.

As noted above, Gadeken et al. disclose the claimed invention, except for a) said first

gamma ray spectrum is measured at a first distance from said neutron source; (b) said second

gamma ray spectrum is measured at a second distance from said neutron source wherein said

second distance is greater than said first distance; (c) said first energy region comprises gamma

radiation with energy greater than gamma radiation in said second energy region; (d) said second

gamma ray spectrum is normalized to said first gamma ray spectrum thereby forming a

normalized second gamma ray spectrum; and (e) said property is determined from a difference

in said down scatter radiation in said second energy regions of said first gamma ray spectrum

and said normalized second gamma ray spectrum.

Tittman teaches a) said first gamma ray spectrum is measured at a first distance from said

neutron source (see col. 2, lines 42-49 and col. 3, line 65 to col. 4, line 8); (b) said second gamma

ray spectrum is measured at a second distance from said neutron source wherein said second

distance is greater than said first distance and (c) said first energy region comprises gamma

radiation with energy greater than gamma radiation in said second energy region (see col. 2, lines

50-56 and col. 4, lines 25-53); (d) said second gamma ray spectrum is normalized to said first

gamma ray spectrum thereby forming a normalized second gamma ray spectrum; and (e) said property is determined from a difference in said down scatter radiation in said second energy regions of said first gamma ray spectrum and said normalized second gamma ray spectrum (see col. 2, lines 56-63 and col. 5, line 60 to col. 7, line 7).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Gadeken et al.'s method to include a) said first gamma ray spectrum is measured at a first distance from said neutron source; (b) said second gamma ray spectrum is measured at a second distance from said neutron source wherein said second distance is greater than said first distance; (c) said first energy region comprises gamma radiation with energy greater than gamma radiation in said second energy region; (d) said second gamma ray spectrum is normalized to said first gamma ray spectrum thereby forming a normalized second gamma ray spectrum; and (e) said property is determined from a difference in said down scatter radiation in said second energy regions of said first gamma ray spectrum and said normalized second gamma ray spectrum, as taught by Tittman, in order to produce output signals that correspond to a characterizing parameter of the mudcake and the average atomic number of the formation (see Tittman, col. 2, lines 60-63).

6.   Claims 10 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tittman in view of Re. 36,012 to Loomis et al.

As noted above, Tittman discloses the claimed invention, except for (a) said first energy region ranges from about 3 MeV to about 7 MeV; and (b) said second energy region ranges from about several hundred keV to about 3 MeV.

Loomis et al. teach (a) said first energy region ranges from about 3 MeV to about 7 MeV; and (b) said second energy region ranges from about several hundred keV to about 3 MeV (see col. 8, lines 53-54).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Tittman's method to include (a) said first energy region ranges from about 3 MeV to about 7 MeV; and (b) said second energy region ranges from about several hundred keV to about 3 MeV, as taught by Loomis et al., in order that gamma rays emitted by the radioactive material can be detected.

As to claim 22, Tittman discloses said first gamma ray spectrum in said second energy region is subtracted from said normalized second gamma ray spectrum in said second energy region to determine said measure of said property (see col. 2, lines 56-63 and col. 5, line 64 to col. 7, line 7).

Tittman does not disclose (a) said first energy region ranges from about 3 MeV to about 7 MeV; (b) said second energy region ranges from about several hundred keV to about 3 MeV.

Loomis et al. teach (a) said first energy region ranges from about 3 MeV to about 7 MeV; (b) said second energy region ranges from about several hundred keV to about 3 MeV (see col. 8, lines 53-54).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Tittman's method to include (a) said first energy region ranges from about 3 MeV to about 7 MeV; (b) said second energy region ranges from about several hundred keV to about 3 MeV, as taught by Loomis et al., in order that gamma rays emitted by the radioactive material can be detected.

7.   Claims 12 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tittman

in view of U. S. Patent No. 5,767,510 to Evans.

As noted above, with respect to claims 12 and 23, Tittman discloses the claimed

invention, except for said neutron source comprises Californium-252.

Evans teaches said neutron source comprises Californium-252 (see col. 9, line 65 to col.

10, line 1).

It would have been obvious to one having ordinary skill in the art at the time the

invention was made to modify Tittman's method to include said neutron source comprises

Californium-252, as taught by Evans, in order to emit fast neutrons.

8.   Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tittman in view

of U. S. Patent No. 4,825,071 to Gadeken et al.

As noted above, Tittman discloses the claimed invention, except for said induced

gamma radiation comprises energies greater than about 3 MeV.

Gadeken et al. teach said induced gamma radiation comprises energies greater than

about 3 MeV.

It would have been obvious to one having ordinary skill in the art at the time the

invention was made to modify Tittman's method to include said induced gamma radiation

comprises energies greater than about 3 MeV, as taught by Gadeken et al., in order that gamma

rays emitted by the radioactive material can be detected.

9.   Claims 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent

No. 3,864,569 to Tittman in view of Re. 36,012 to Loomis et al.

With respect to claims 27-29, Tittman discloses a method for determining bulk density of

an earth formation penetrated by a borehole, the method comprising the steps of: (a) inducing

gamma radiation within said formation by means of a neutron source (see col. 2, lines 42-49 and

col. 3, line 65 to col. 4, line 8); (d) measuring gamma ray counts resulting from said induced

gamma radiation in said low energy window at a second axial spacing from said neutron source,

wherein said second spacing is greater than said first axial spacing and (e) measuring gamma ray

counts resulting from said induced gamma radiation in said high energy window at said second

axial spacing (see col. 2, lines 42-56 and col. 3, line 65 to col. 4, line 53); (f) computing a

normalization factor by dividing said gamma ray counts measured at said first spacing in said

high energy window by said gamma ray counts measured at said second axial spacing in said

high energy window; (g) computing a normalized gamma ray count for said low energy window

at said second axial spacing by multiplying said normalization factor by said gamma ray counts

measured in said low energy window at said second axial spacing; (h) computing a low energy

window count difference by subtracting said gamma ray count measured at said first axial

spacing in said low energy window from said normalized gamma ray count; (i) correcting said

low energy window count difference for effects of formation lithology to form a corrected low

energy window count difference; and (j) determining said bulk density from said lithology

corrected low energy window count difference using a predetermined functional relationship (see

col. 2, lines 56-63 and col. 5, line 60 to col. 7, line 7).

Tittman does not disclose (b) measuring gamma ray counts resulting from said induced

gamma radiation in a low energy window extending from about several hundred keV to about 3 MeV at a first axial spacing from said neutron source; (c) measuring gamma ray counts resulting from said induced gamma radiation in a high energy window extending from about 3 MeV to above 7 MeV at said first axial spacing.

Loomis et al. teach (b) measuring gamma ray counts resulting from said induced gamma radiation in a low energy window extending from about several hundred keV to about 3 MeV at a first axial spacing from said neutron source; (c) measuring gamma ray counts resulting from said induced gamma radiation in a high energy window extending from about 3 MeV to above 7 MeV at said first axial spacing (see col. 8, lines 53-54).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Tittman's method to include (b) measuring gamma ray counts resulting from said induced gamma radiation in a low energy window extending from about several hundred keV to about 3 MeV at a first axial spacing from said neutron source; (c) measuring gamma ray counts resulting from said induced gamma radiation in a high energy window extending from about 3 MeV to above 7 MeV at said first axial spacing, as taught by Loomis et al., in order that gamma rays emitted by the radioactive material can be detected.

Conclusion

10.   The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Wilson discloses methods and apparatus for determining gas saturation, liquid saturation, porosity and density of earth formations penetrated by a well borehole.

Stoller et al. disclose an advanced method for determining formation density in an array-detector density tool using three or more detectors to yield an improved accuracy and precision of the formation density measurement even in the presence of a large standoff between the tool and the formation.

Becker et al. disclose a method/apparatus for determining the density of a formation traversed by a borehole having irregularities along the borehole wall preferably employs/includes a housing, a photon source, and a detector.

Badruzzaman discloses an apparatus for measuring the density of a subterranean formation from within a wellbore, especially a cased wellbore.

Evans et al. disclose apparatus for determining the density of underground formations surrounding a borehole, such as a wireline logging tool or a logging-while-drilling tool, including a neutron source for irradiating the formations from within the borehole and at least one detector which detects neutrons and gamma rays in the borehole resulting from the irradiation of the formations with neutrons.

Mickael et al. disclose a method of measuring the density of an earth formation penetrated by a wellbore.

Meisner discloses a computer-based well logging system for acquiring nuclear well log data, including gamma ray energy spectrum and neutron population decay rate data, and providing a real-time preentation of the data on an operator's display based on a traversal by a downhole instrument of a prescribed borehole depth interval.

Evans discloses method and apparatus for radiological investigation of subterranean multicomponent media such as borehole fluids, and subterranean earth formations.

Contact Information

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carol S. Tsai whose telephone number is (703) 305-0851. The examiner can normally be reached on Monday-Friday from 7:30 AM to 4:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marc S. Hoff can be reached on (703) 308-1677. The fax number for TC 2800 is (703) 308-7382. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the TC 2800 receptionist whose telephone number is (703) 308-1782.

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Carol S. Tsai

06/07/03

MARC S. HOFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800